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Infrastructure and Environment

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seafish

Marine Management Organisation

**Dr Llucia Mascorda-Cabre**

**&**

**Dr Emma Sheehan,**

Dr Tim Scott, Dr Clare Embling, Dr Thomas Stamp,

Dr Dannielle Eager, Amy Cartwright

University of Plymouth

aMER – applied Marine Ecosystems Research


SAGB 54TH ANNUAL CONFERENCE 2024

# ROPES TO REEFS

## FISP PROJECT

a partnership to promote sustainable aquaculture that delivers ecosystem and fisheries benefits

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Shellfish Association of Great Britain

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# Applied Marine Ecosystems Research

## Research Focus

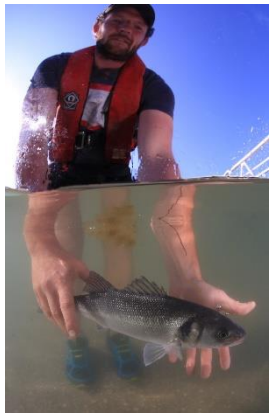
- Marine Protected Areas
- Ecosystem Based Fisheries Management
- Blue offshore industries (mariculture & renewables)

## Expertise

- Underwater video
- Acoustic Telemetry

## Local Fishing boats for research





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# Studies calling for change

Journal of Applied Ecology

*Journal of Applied Ecology* 2009, **46**, 1145–1153 doi: 10.1111/j.1365-2664.2009.01697.x

## Marine renewable energy: potential benefits to biodiversity? An urgent call for research

**Richard Inger[1], Martin J. Attrill[2], Stuart Bearhop[1], Annette C. Broderick[1], W. James Grecian[2], David J. Hodgson[1], Cheryl Mills[1], Emma Sheehan[2], Stephen C. Votier[2], Matthew J. Witt[1] and Brendan J. Godley*[,1]**

[1]*Centre for Ecology and Conservation and Peninsula Research Institute for Marine Renewable Energy (PRIMaRE), School of Biosciences, University of Exeter, Cornwall Campus. Penryn, Cornwall TR10 9EZ, UK; and* [2]*Marine Biology & Ecology Research Centre, PRIMaRE and Marine Institute, University of Plymouth, Drake Circus, Plymouth, Devon PL4 8AA, UK*

ELSEVIER

Renewable and Sustainable Energy Reviews

Volume 74, July 2017, Pages 848-859

## Turning off the DRIP ('Data-rich, information-poor') – rationalising monitoring with a focus on marine renewable energy developments and the benthos

Thomas A. Wilding [a], Andrew B. Gill [b], Arjen Boon [c], Emma Sheehan [d], Jean–Claude Dauvin [e], Jean-Philippe Pezy [e], Francis O'Beirn [f], Urszula Janas [g], Liis Rostin [h], Ilse De Mesel [i]

Show more

https://doi.org/10.1016/j.rser.2017.03.013



ELSEVIER

Marine Policy

Volume 117, July 2020, 103864

## Emerging themes to support ambitious UK marine biodiversity conservation

Siân E. Rees [a], Emma V. Sheehan [a], Bryce D. Stewart [b], Robert Clark [c], Thomas Appleby [d], Martin J. Attrill [a], Peter J.S. Jones [e], David Johnson [f], Natasha Bradshaw [d], Simon Pittman [a g], Jenny Oates [h], Jean-Luc Solandt [i]

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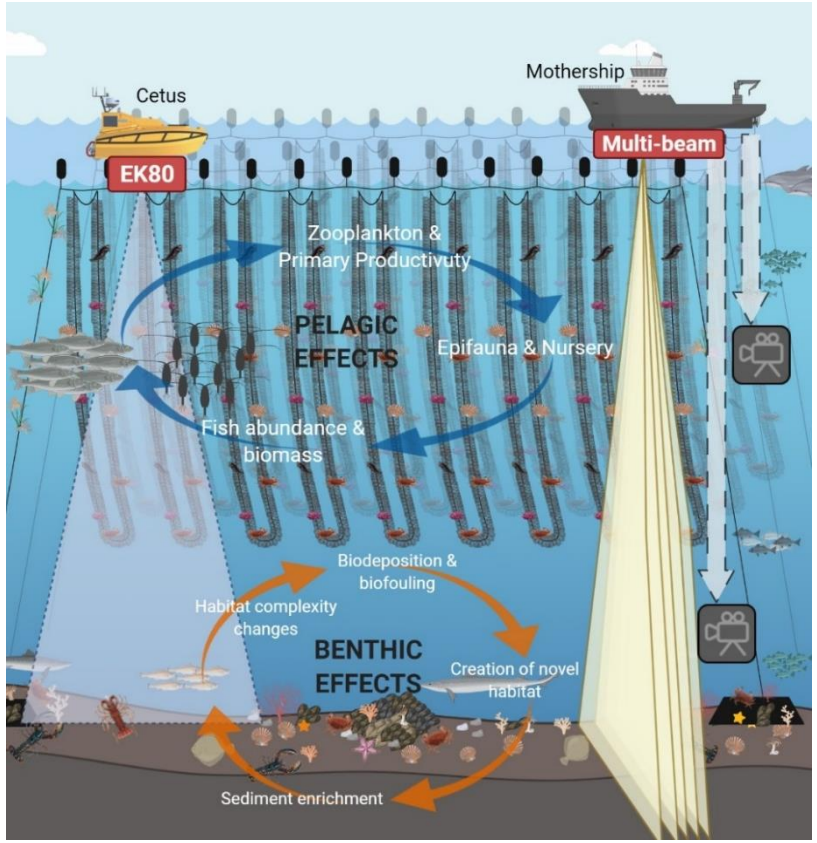
# Ropes to Reefs

UK Seafood Fund: Fisheries Industry Science Partnerships scheme (FISP)

- A fisher, farmer, scientist collaboration to inform future management and policy.
- Moving from site to wider ecosystem benefits (fisheries & conservation)
- The project aims to assess the restorative effect of Offshore Aquaculture on **essential fish habitat, fish biomass and distribution** and its **ecosystem services** and benefits.

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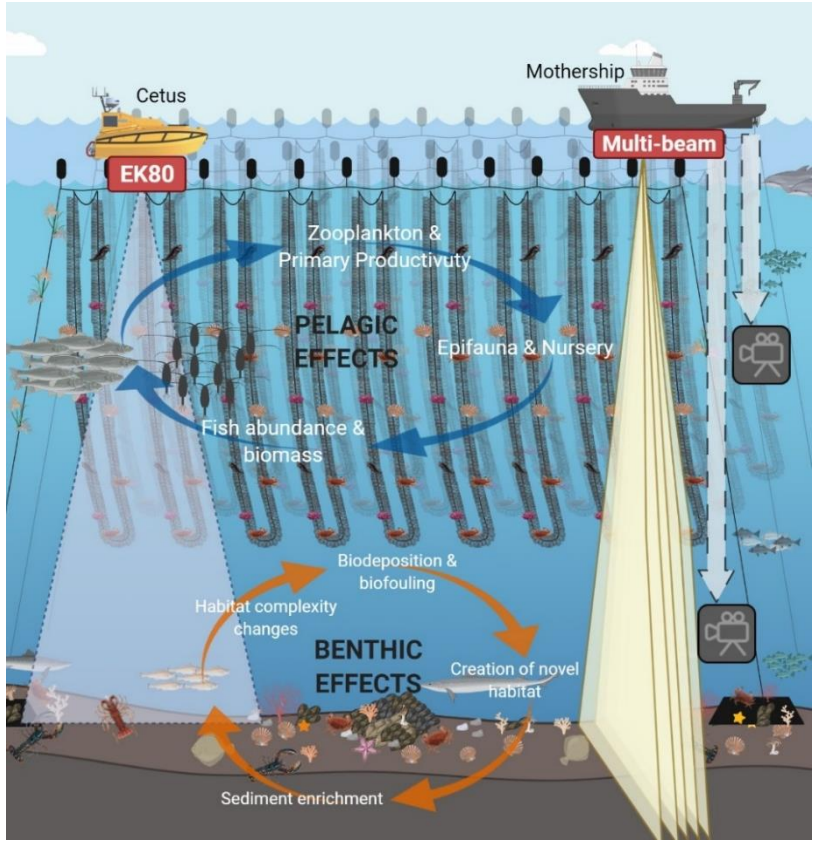
# Ropes to Reefs

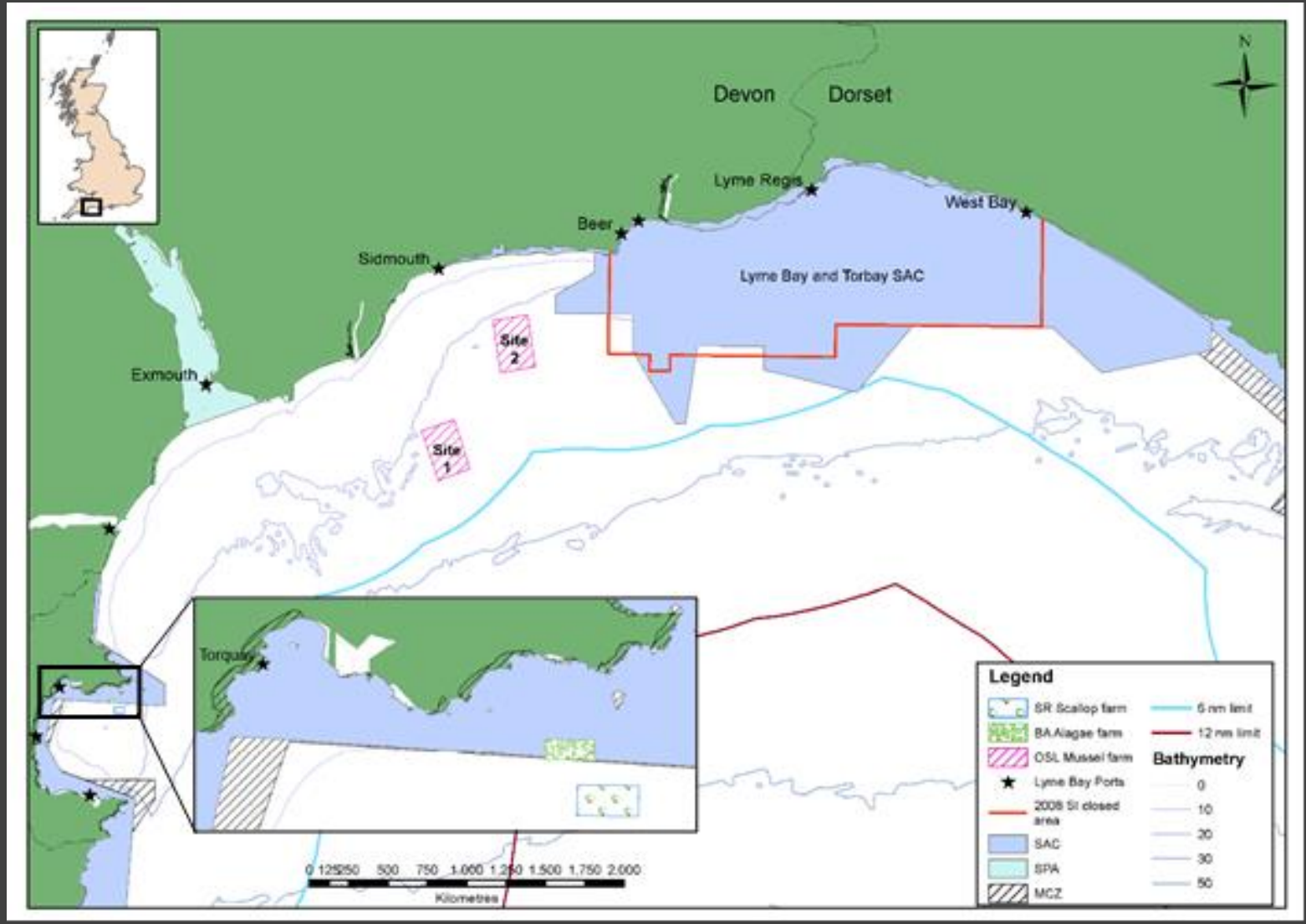
The partners:

- Scientists: Interdisciplinary team University of Plymouth
- Farmers: Offshore Shellfish Ltd, Biome Algae Ltd and Scallop Ranch Ltd
- Fishers: Lyme Bay fishers
- Industry body: Shellfish Association of Great Britain



# Study sites

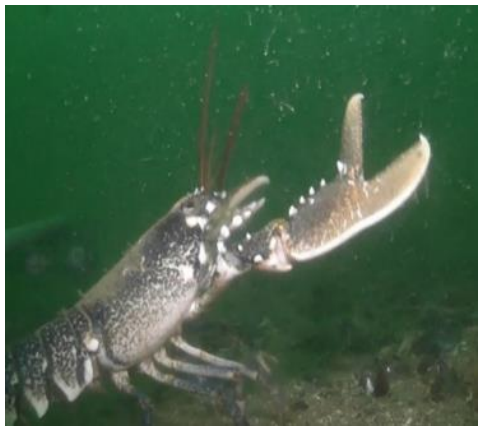
- Offshore Shellfish Ltd (OSL) farm
  - UK's first large scale offshore mussel farm
  - Two developed sites (10km²)
  - Located on historically trawled ground
- Scallop Ranch
- Biome Algae
- Lyme Bay MPA

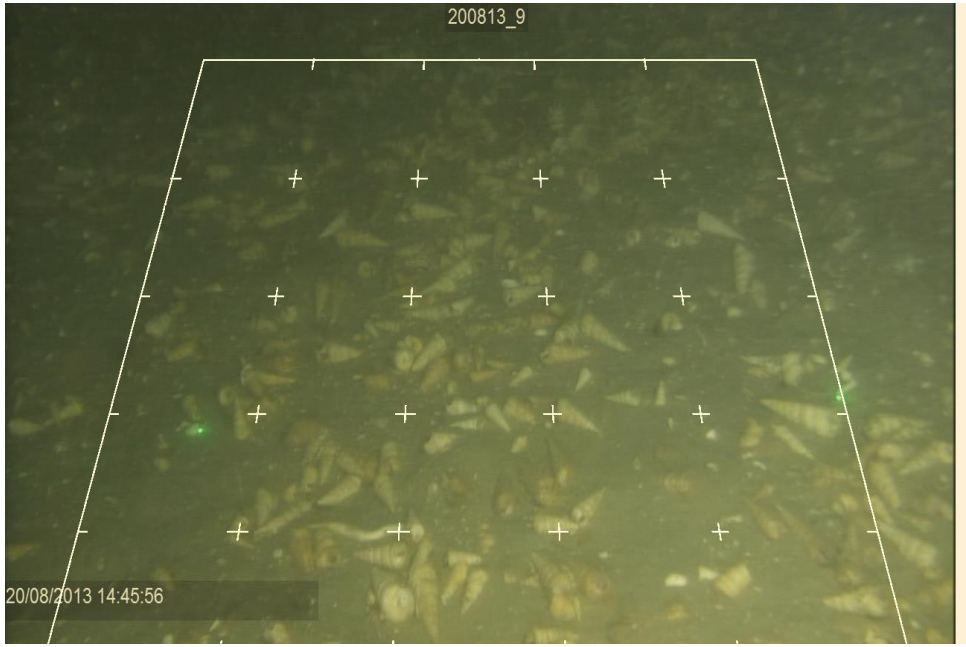


# OSL long-term research study

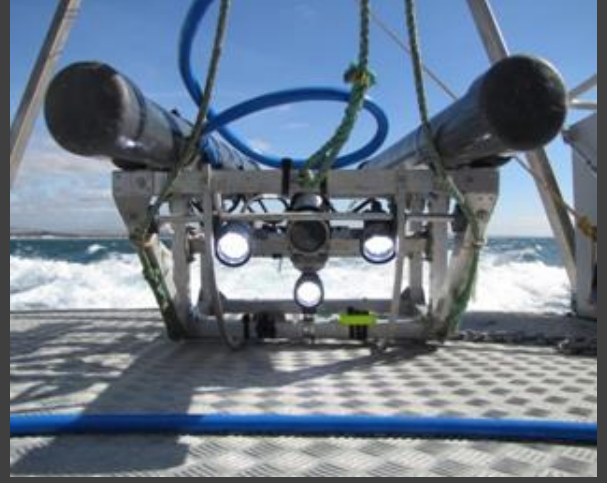
- To assess the overall footprint of the farm
  - Hydrodynamic changes
  - Sediment transport & plankton depletion
  - Functional change of benthic & pelagic species (commercially targeted)

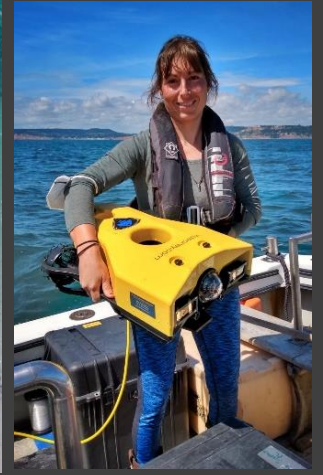
- Before After Control Impact (BACI) design
  - Baseline – 2013/2014 (degraded)
  - PhD#1 - 2015/2017 (Site 1 and 2)
  - PhD#2 - 2018/2020 (Site 2)
  - PhD#3 - 2023/2027 (Site 2)





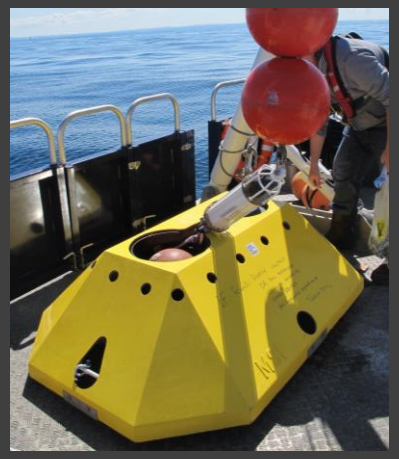
# Survey techniques









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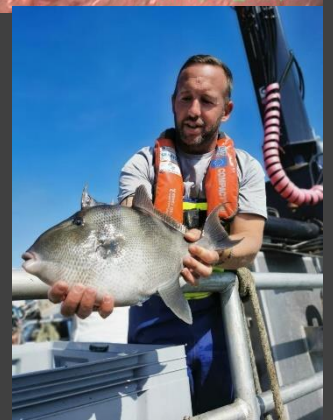
Hdg: 111.7° [114.1°]
Temp: 16.6° C
09/10/19 09:50:09


Temp: 15.8° C
07/30/20 10:26:37


Dpt: 24.0m
P: -11.3°
R: 8.1°



# RESULTS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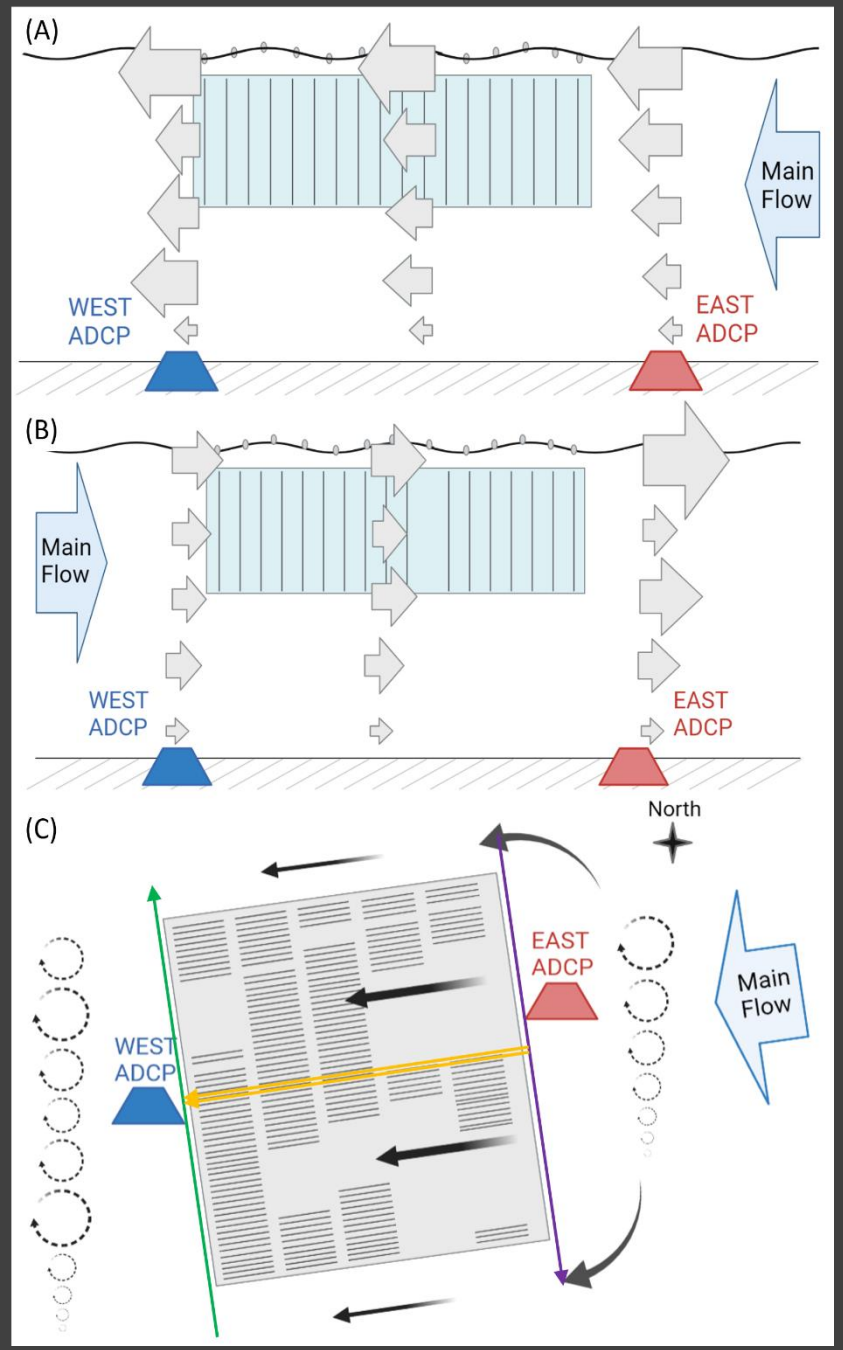



# Highly hydrodynamic offshore conditions

Aquaculture 585 (2024) 740697

Contents lists available at ScienceDirect

Aquaculture

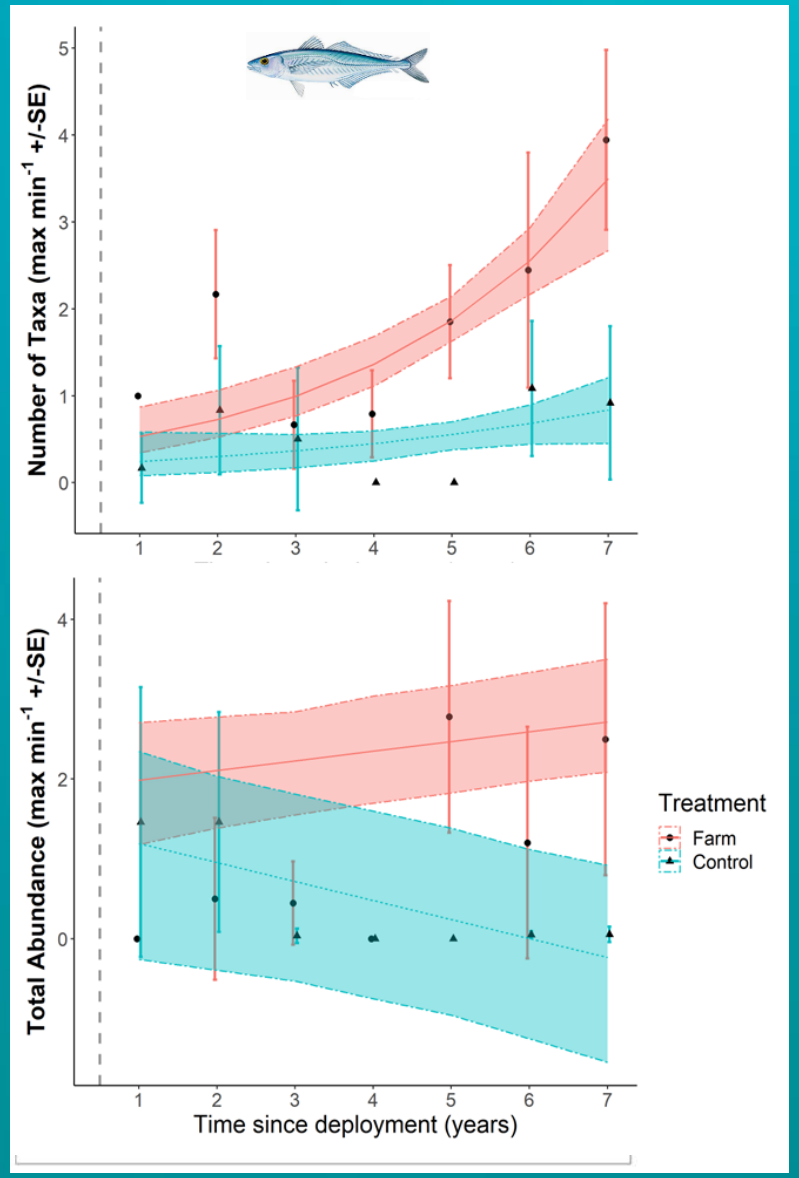
journal homepage: www.elsevier.com/locate/aquaculture

## Assessing the impact of an offshore longline mussel farm on local water circulation in a highly hydrodynamic energetic bay

Llucia Mascorda-Cabre *, Emma V. Sheehan, Martin J. Attrill, Phil Hosegood

*School of Biological and Marine Sciences, Faculty of Science and Engineering, University of Plymouth, Plymouth, UK*

# Pelagic communities




AQUACULTURE, FISH and FISHERIES

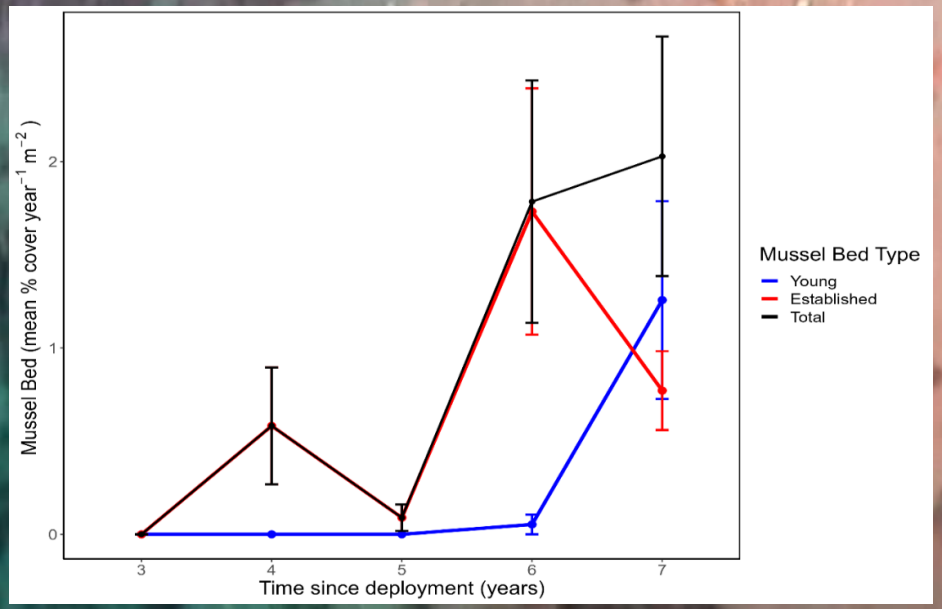
Forward Series

ORIGINAL ARTICLE | Open Access

## The aggregation effect of offshore mussel farming on pelagic fishes

Danielle Bridger, Martin J. Attrill, Siân E. Rees, Emma V. Sheehan

# Biogenic reef development



# Benthic communities

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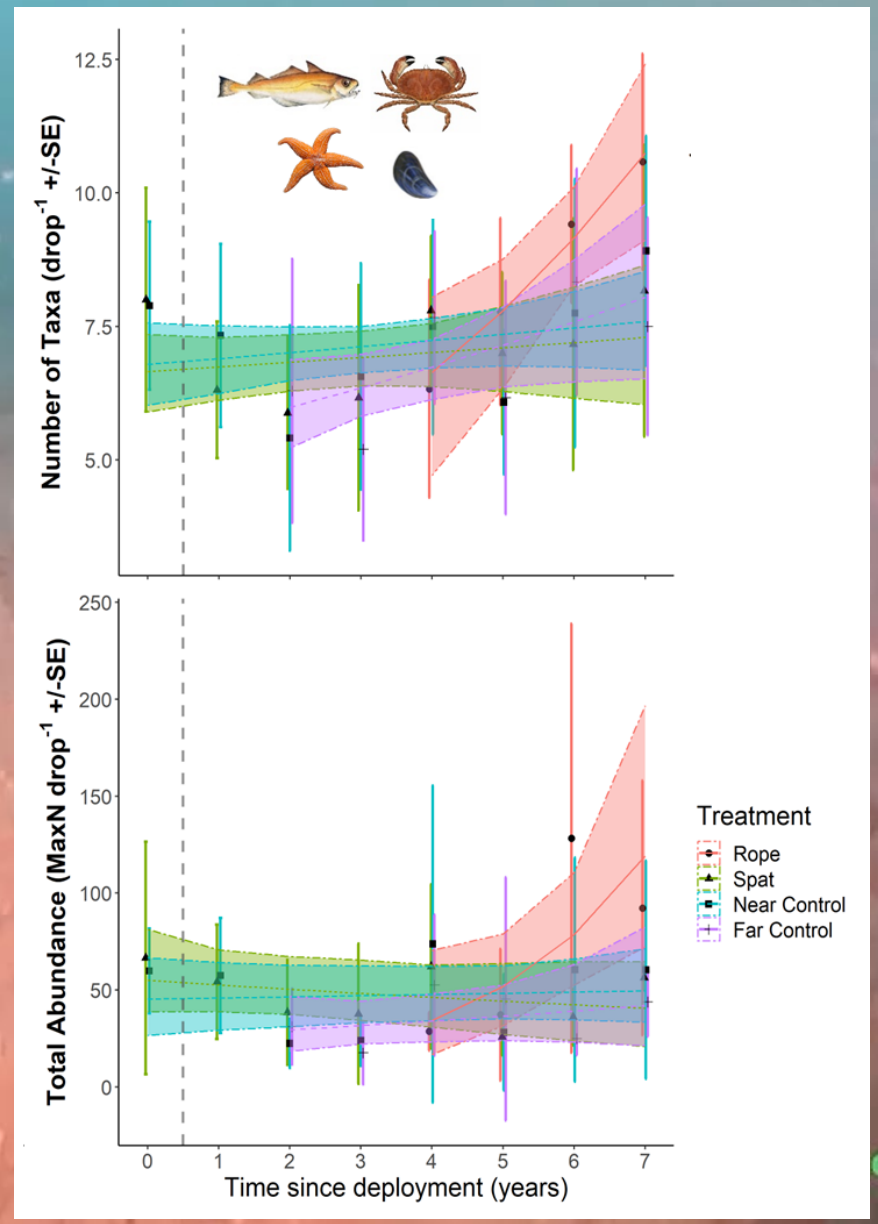
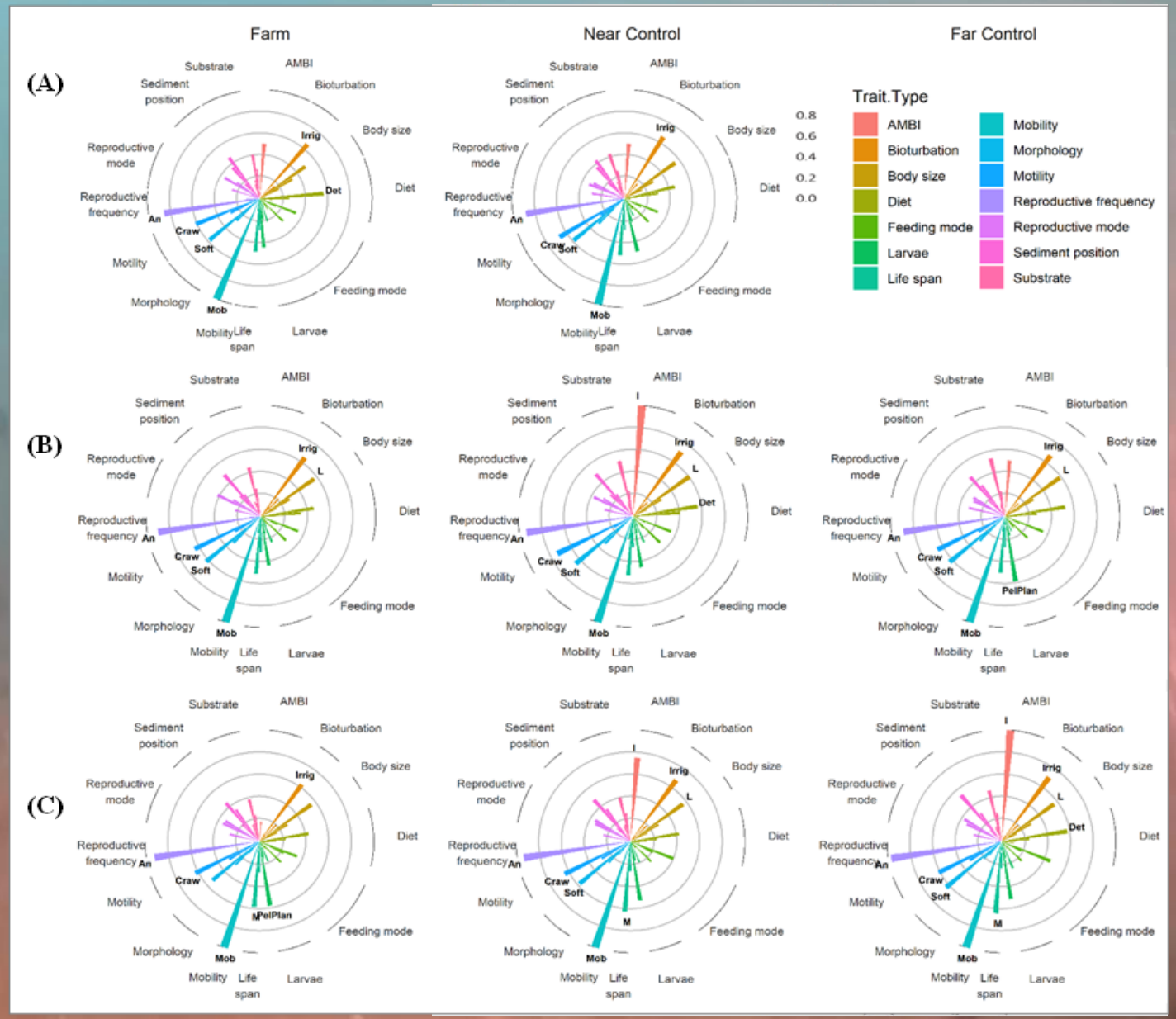
REVIEW ARTICLE | Open Access

## The restoration potential of offshore mussel farming on degraded seabed habitat

Danielle Bridger, Martin J. Attrill, Bede F. R. Davies, Luke A. Holmes, Amy Cartwright, Siân E. Rees, Llucia Mascorda Cabre, Emma V. Sheehan



# Infauna communities




Marine Pollution Bulletin 195 (2023) 115556

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Detecting sediment recovery below an offshore longline mussel farm: A macrobenthic Biological Trait Analysis (BTA)

Llucia Mascorda-Cabre *, Phil Hosegood, Martin J. Attrill, Danielle Bridger, Emma V. Sheehan

*School of Biological and Marine Sciences, Faculty of Science and Engineering, University of Plymouth, Plymouth, UK*

- Offshore aquaculture as ***de facto*** **MPA**
  - Exclusion of fishing activities (mobile gear)
  - Restoration & habitat recovery
  - FAD, nursery, refuge and shelter
  - Boost biodiversity - Spillover effect
  - Sustainable sources of protein

# Aquaculture & Conservation



# Conservation & Sustainable development

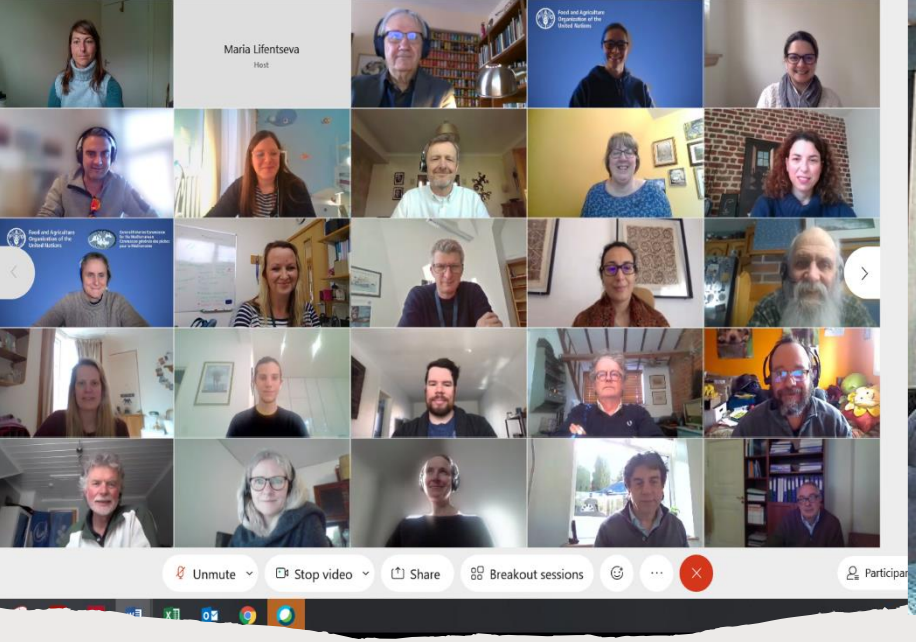
-

# Offshore aquaculture as *de facto* MPAs

- Marine biodiversity declines
- International conservation targets –

  Aichi Target 11 & 6, SDGs 14 & 2
- Blue Economy's role – offshore aquaculture
- Offshore aquaculture as *de facto* MPA

  =
- Conservation achieved as a by-product of other management - OECM





# OECMs – Lyme Bay Offshore Mussel farm: as a case study

## OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES

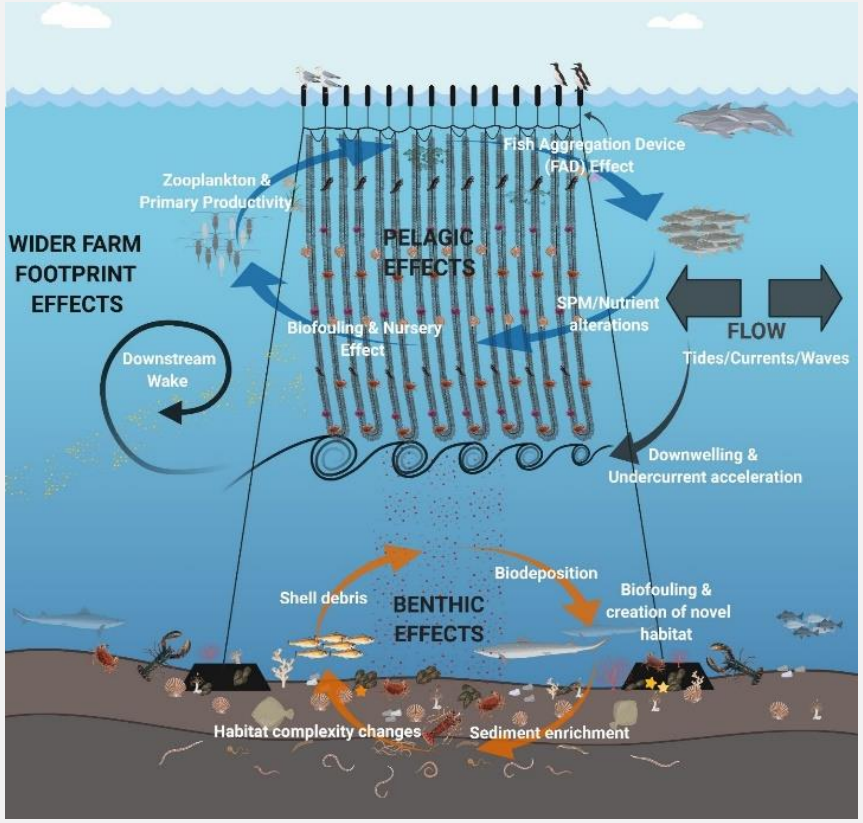
- As defined by the 14th Conference of Parties of the Convention on Biological Diversity in 2018:

*"A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in-situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio–economic, and other locally relevant values."*

## Joint ICES/IUCN-CEM FEG workshop on testing OECM practices & strategies

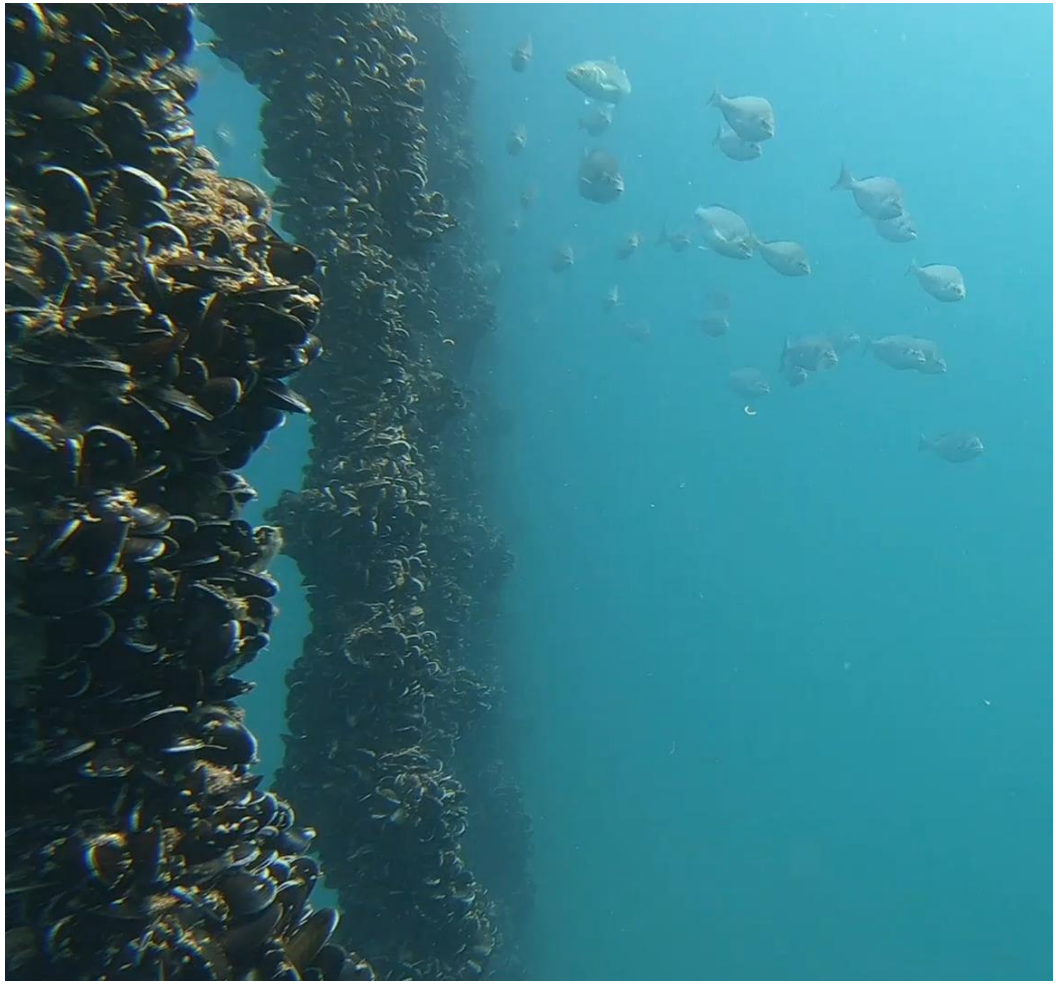
# OECM - Assessment of the area against CBD Criteria

| Criterion | Description | Mussel Farm |
|---|---|---|
| A | Area is not recognized as a protected area | ✓ Not an MPA |
| B | Area is governed and managed | ✓ Licence (MMO & The Crown State)<br>✓ Geographically defined space<br>✓ Contribute to restoration & conservation of biological diversity |
| C | Achieves sustained & effective contribution to *in situ* conservation of biodiversity (Long-term in situ biodiversity conservation outcomes) | ✓ Exclusion of destructive activities<br>✓ Allowing recovery<br>✓ Create habitat<br>✓ Restoration<br>✓ Increase in biodiversity<br>✓ Long-term monitoring |
| D | Associated ecosystem functions and cultural, spiritual and socio economic values | ✓ Potential climate change positive industry: increase water quality, carbon sequestration<br>✓ Spillover/commercially valuable species/ecosystem services<br>✓ Improving local/recreational fishing grounds - create jobs |

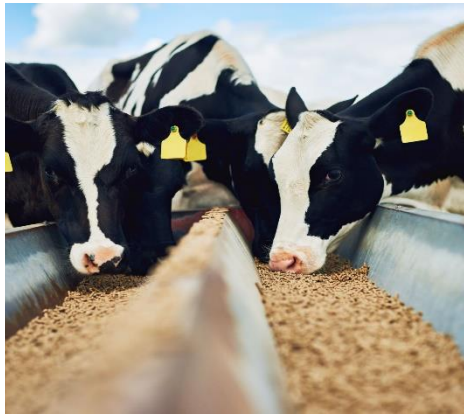



(**Mascorda Cabre *et al.*, 2021**)

# Mussel farm's yearly protein production - equivalence



**850 tonnes of offshore mussels**



4,000 beef cattle

320,000 salmon

32,000 sheep

470,000 chickens

# And what now… Ropes to Reefs

# Aims & objectives of Ropes to Reefs

- New scientific data on the **ecosystem services of offshore bivalve aquaculture**
- **Study the connectivity** with Lyme Bay **MPA,** spillover effect and natural capital
- **Fill scientific knowledge gaps on fishes and crustaceans & advice sustainable fisheries management strategies**
- Provide regulators with the evidence needed:
    - **Ecosystem Based Fisheries Management (EBFM)**
    - **sustainable development** and management of offshore aquaculture
- Provide industry and government with HARD evidence to address current industry development issues such as licensing, impacts and public perception

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# Aims & objectives of Ropes to Reefs

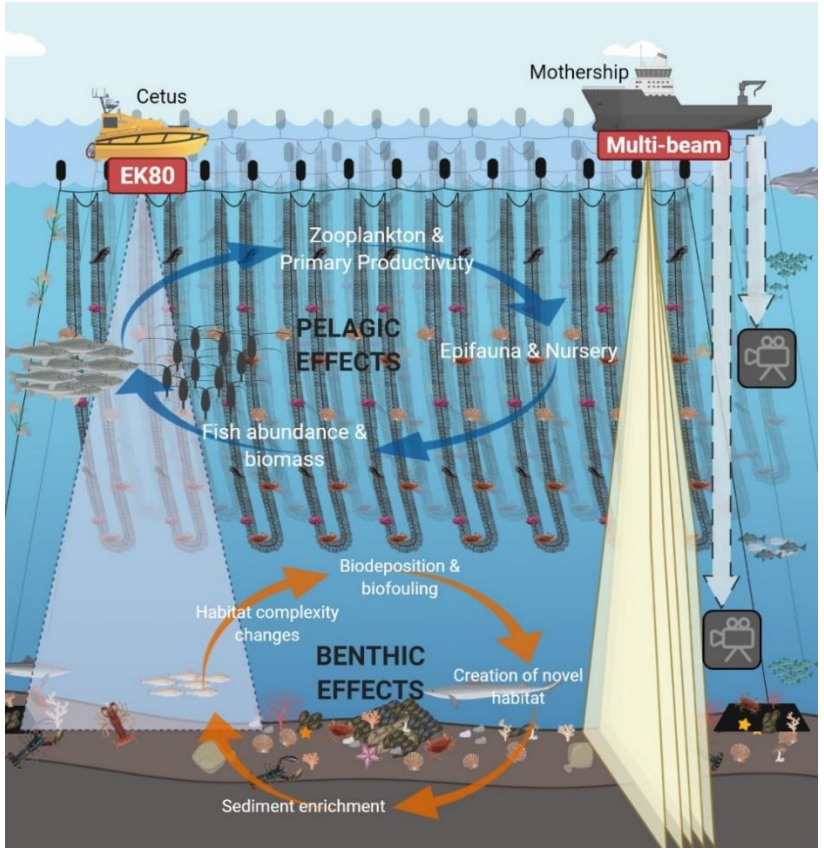
Inform

- **Fisheries Management Plans** (Crab & Lobster FMP, Whelk FMP, King Scallop FMP, Bass FMP, The Channel NQS FMP, Skates & rays FMP)
- **D&S IFCA's Mariculture Strategy**
- **DEFRA's Marine Spatial Prioritisation strategy** towards more sustainable industry while achieving **Net Zero** and **Good Environmental Status (GES)**

Support the industry in

- Communicating **positive impacts** of aquaculture - **ecosystem services**
- Role on the **UK's Biodiversity Net Gain** plans and its role as a **nature-based solution (Blue Economy)**

# Bathymetry study

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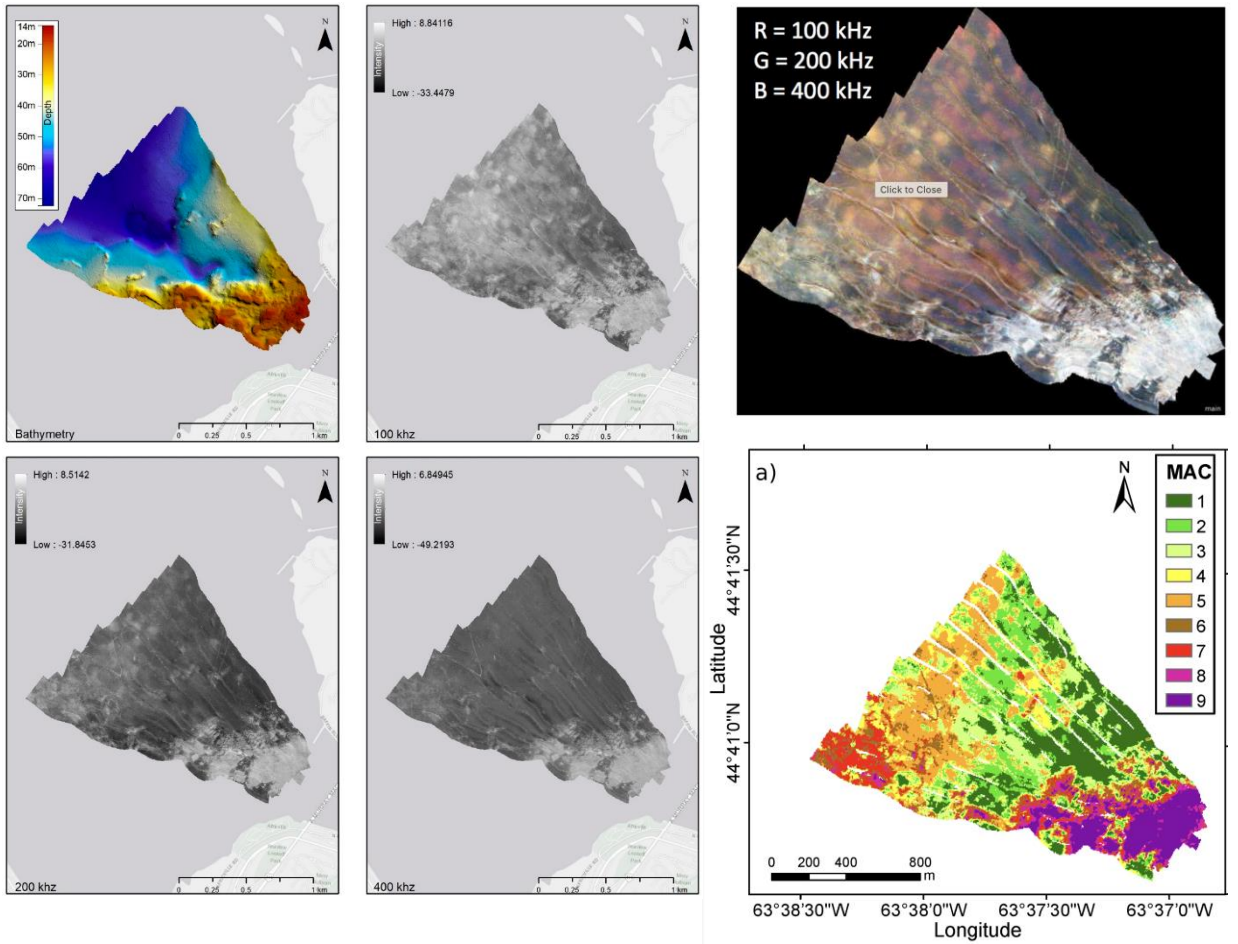
# High-resolution seabed mapping

**Aims**

- Map the seabed beneath and proximal to the farm
  - high-res assessment of morphology and multispectral backscatter
  - substrate type habitat classification
  - mussel clumps and mussel reef formation

**Methods**

- R2Sonic 2024 **multi-beam echosounder (MBES)** high-resolution (<0.1 m) **bathymetry** and acoustic **backscatter** data
- Seabed substrate ground truth using drop camera, and ROV data

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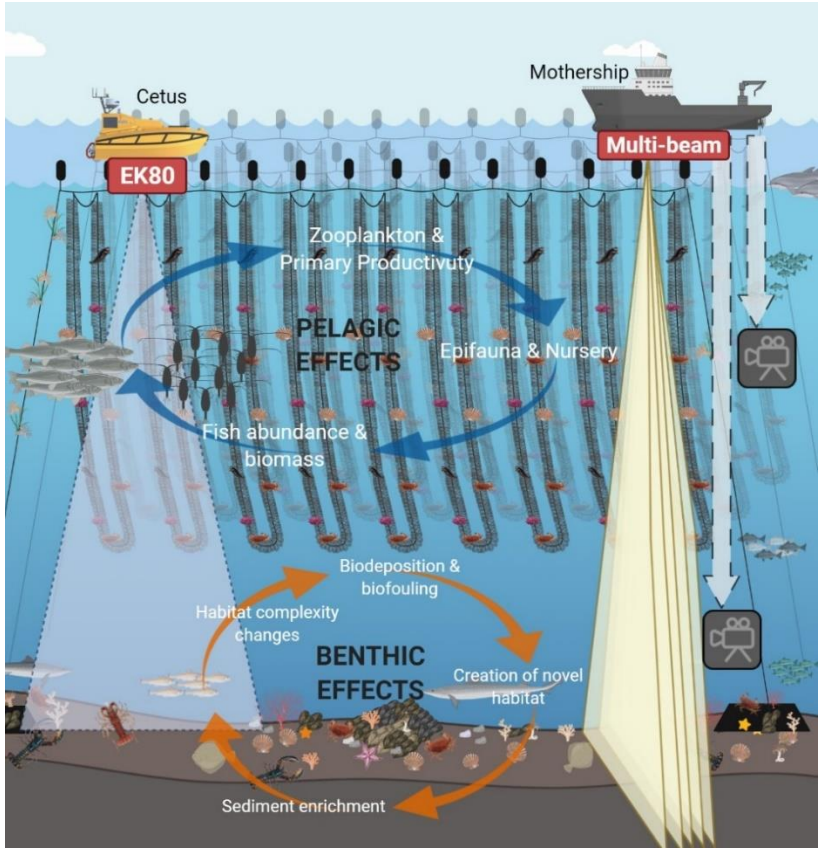
# Fisheries Acoustics study

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# Fisheries Acoustics study

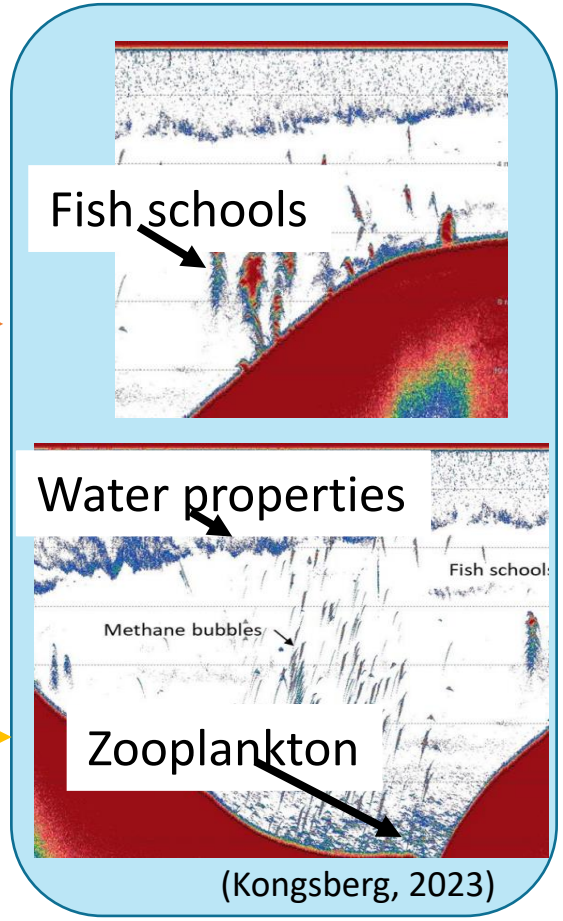
- 2 frequencies:
- EK80 captures 90 % of the water column

**EK80**

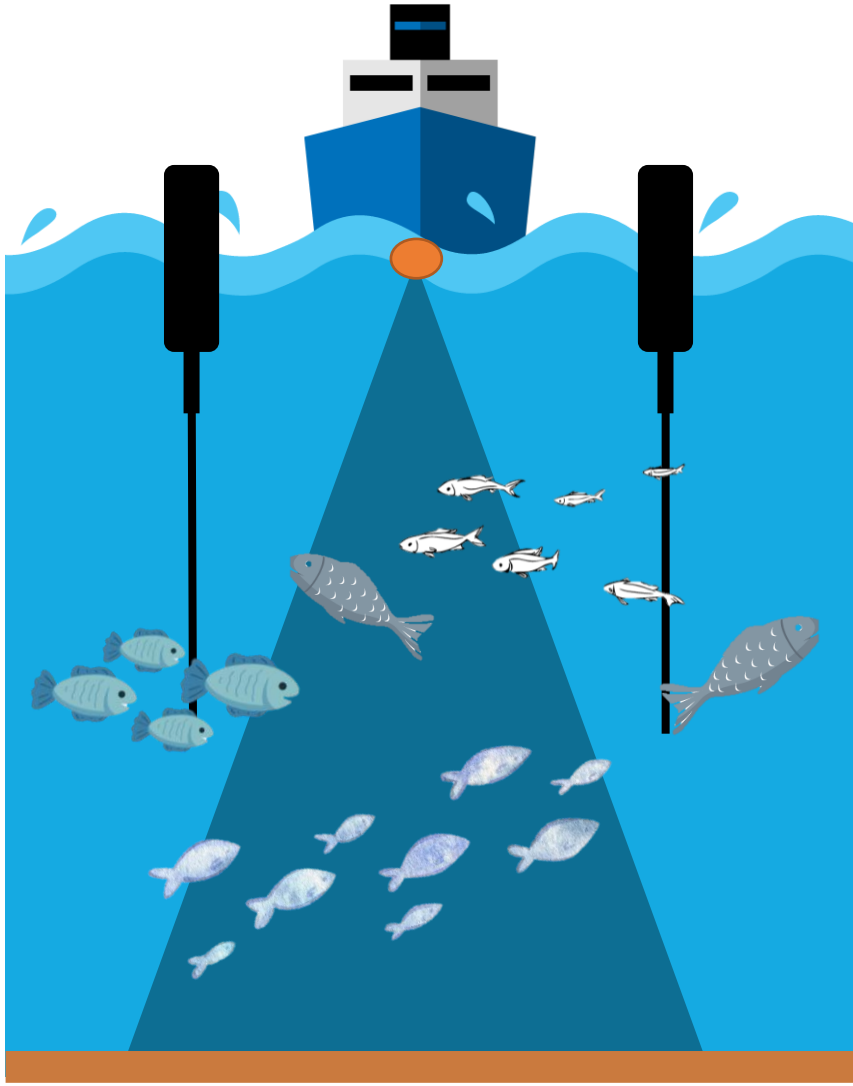
WBT Mini

38 kHz (Fish)

120 kHz (Fish & plankton)




(Kongsberg, 2023)



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# Fisheries Acoustics study

## 1. Essential Fish Habitat assessment – Fine scale farm survey

*Aim: To assess fish biomass, abundance, diversity & schooling behaviour to estimate fish stocks and identify EFH use within the mussel farm*

## 2. Spillover assessment – Broad farm and MPA survey

*Aim: To assess connectivity & schooling behaviour to estimate fish stocks and spillover effect between the mussel farm and MPA.*

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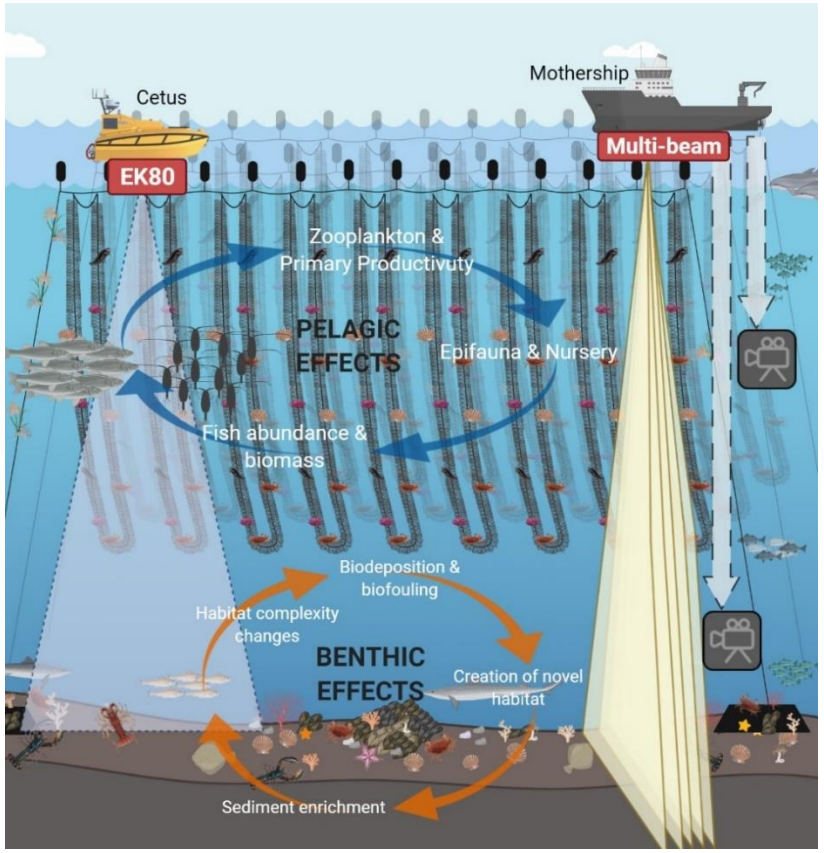
# Telemetry study

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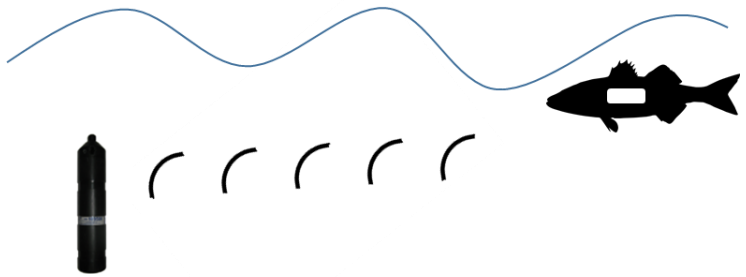
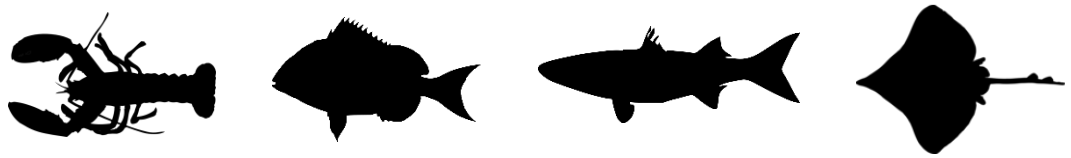
# Acoustic telemetry

- Fish tagged with acoustic transmitters
- Transmitters send "ping" every ~2 minutes
- Pings detected by network of underwater receivers

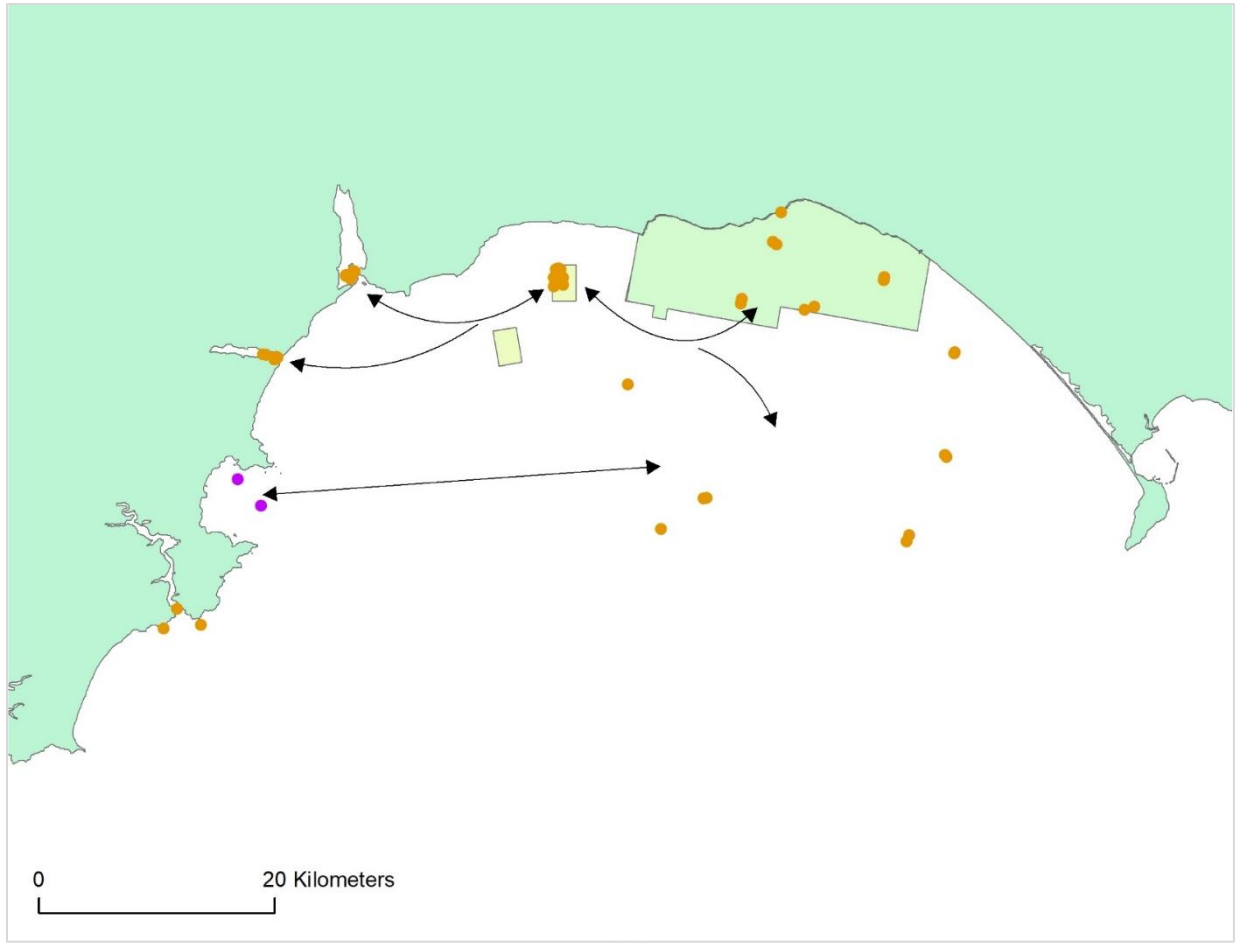


# Telemetry study – Fish tracking



Aims:

- Identify habitat provided by aquaculture sites
- Assess spillover effects
- Assess wider connectivity with marine environment e.g. migration routes

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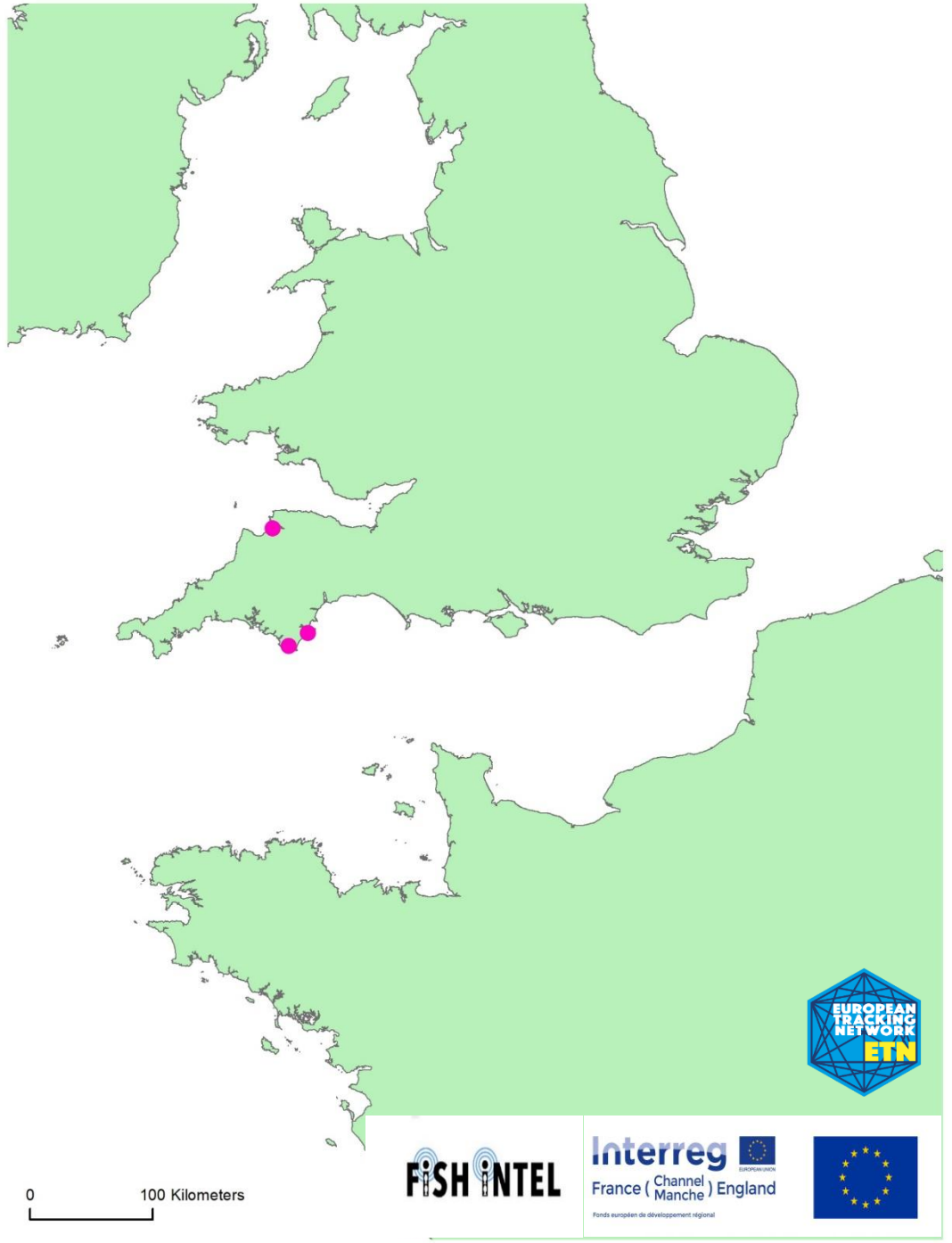
NATURAL ENGLAND

# The growth of the large-scale tracking network

- Receiver coverage across English Channel increasing rapidly, most notably through UoP-led FISH INTEL project
- Collaborative, continental-scale research increasingly facilitated through networks such as ETN

| **I-BASS** | **ROPE/ Spill over** | **FISH INTEL** | **FISP** |
|---|---|---|---|
| 2018 – 2020 | 2020 | 2021-2023 | 2023-2024 |
| Tom Stamp PhD | Crab & Lobster on offshore mussel farm | Multispecies Cross Channel network | Pollack, Black bream & Elasmobranchs |
| Bass in Estuaries | | | |



# Context

***Blue Industries bring lots of opportunities*** *for scientists developing innovative techniques for monitoring marine ecosystems, with* ***potential benefits for both Fisheries and Conservatio*** ***(ICES WGMPAS)***

***BUT – scale and location remain essential components for any future development***

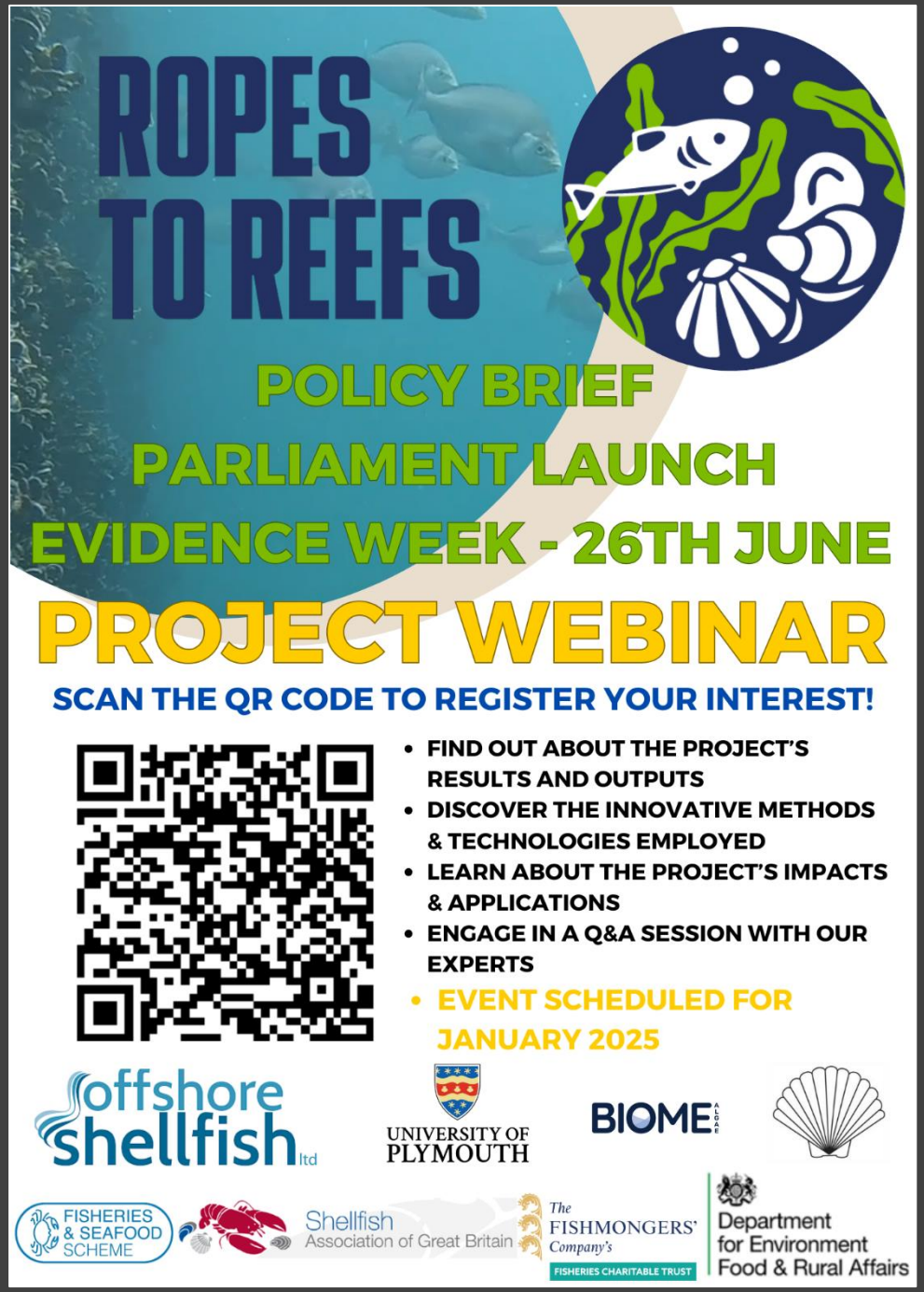
- *If we choose to designate sites as* ***OECMs they must optimise the MPA network not replace*** *or compromise it*
- ***Blue industries can help restore ecosystem function of degraded habitats****, but could equally negatively impact pristine habitats*
- *Lots still to learn*

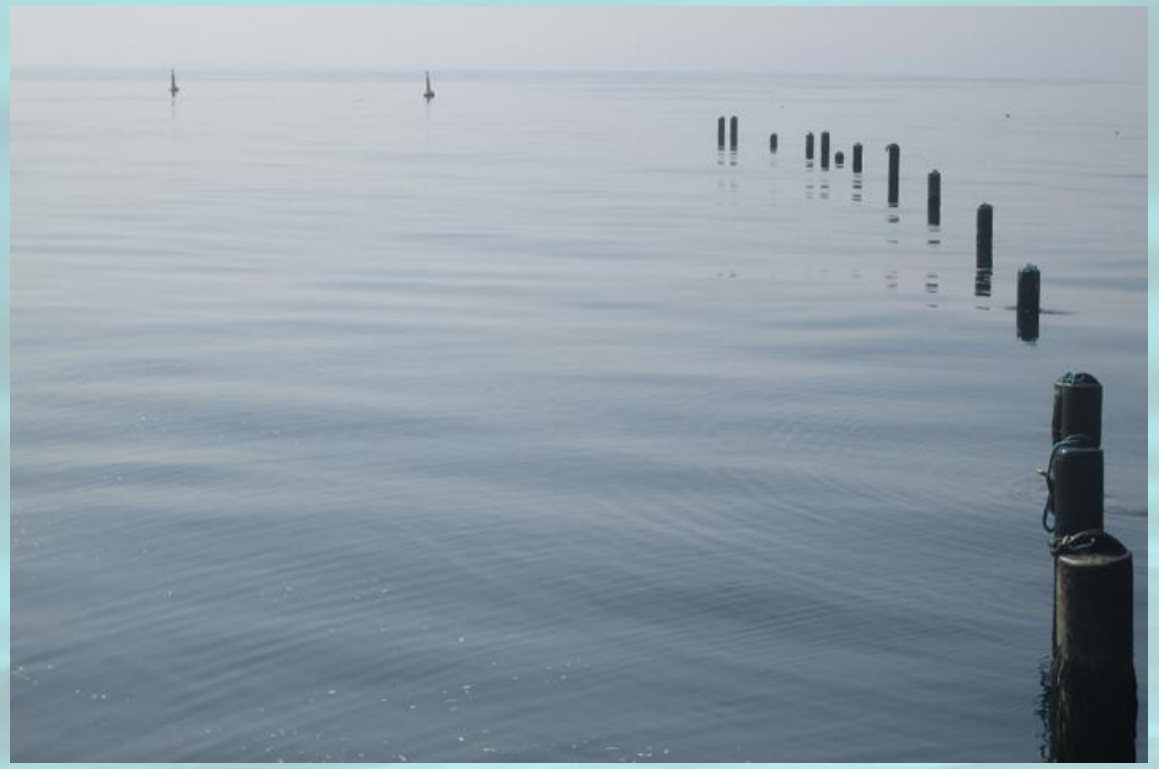
***Ropes to Reefs is an exciting opportunity to evidence all these benefits…***

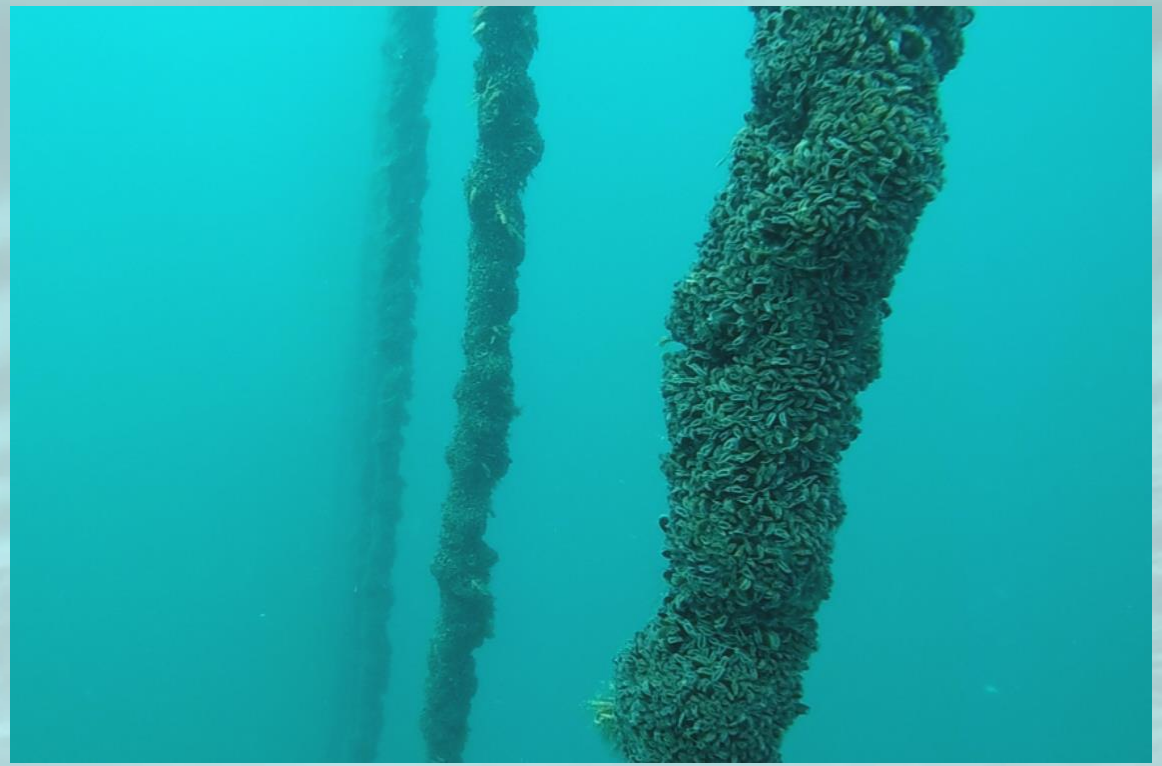
# What's next?

- **POLICY BRIEF** – Launched in Parliament during Evidence Week (TBD - autumn)

- **PROJECT WEBINAR** January 2025 – please register your interest







# Thank you

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# 54th Annual Conference

Shellfish Association of Great Britain

#SAGB54